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Plant Conservation in the Future: New Challenges, New Opportunities

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Abstract: Throughout the world, plant diversity is being reduced rapidly by the extinction of species and of local differentiated populations. In presenting possible solutions to this very serious problem I will first briefly describe the factors that have led to the development of China's wealth of biodiversity; then examine the causes of extinction, with an emphasis on the situation in China; and conclude with recommendations on how to most effectively conserve plants in this huge and botanically diverse country.

Key words: Plant diversity; Biological richness; Human impacts; Plant conservation in China; Strategies for plant conservation

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Throughout the world, plant diversity is being reduced rapidly by the extinction of species and of local differentiated populations. In presenting possible solutions to this very serious problem I will first briefly describe the factors that have led to the development of China's wealth of biodiversity; then examine the causes of extinction, with an emphasis on the situation in China; and conclude with recommendations on how to most effectively conserve plants in this huge and botanically diverse country. What I will have to say here about plant diversity applies to biodiversity generally, but the most effective ways to preserve the diversity of other groups of organisms are often specific to those groups.

China's biological richness

China, Europe, and the United States are approximately of equal size, but China is much richer in biodiversity than the other two areas. For example, China has about 31 500 species of vascular plants; the United States about 19 000; and Europe about 11 500. What accounts for these differences?

There are several historical and contemporary factors at play in this regard. First, the long period of climatic deterioration and differentiation of habitats that has taken place from the Middle Miocene Period (15 my) onward and to a lesser extent the climatic extreme cycles of the Pleistocene have been important causes of extinction throughout the Northern Hemisphere. As these changes have occurred, China's geography has clearly provided more opportunities for survival than that of the other two regions. Thus, the Hengduan and Qinlin mountains of south-central China extend into the tropics and are virtually continuous with other ranges to the south. During cooler periods, species of plants and animals could migrate to the south, returning when milder and warmer climates were reestablished. In North America, the southern end of the Appalachian Mountains lies far north of the tropics, with survival of the earlier, richer and more diverse biological communities taking place primarily in relatively limited areas such as the coast of the Carolinas and the Edwards Plateau region of central Texas. Further south, the growing deserts and Gulf of Mexico clearly limited the possibilities for southward migration and survival. In Europe, the Alps and the Mediterranean effectively blocked migration to the south, a

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condition that demonstrably led to massive extinction of the earlier biota of that occurred in the region.

Prior to the Middle Miocene, the fossil record of the temperate Northern Hemisphere demonstrates a relatively uniform biological richness across Eurasia and North America. For example, 40 million years ago, *Metasequoia* occurred widely in southern Europe and was the most abundant kind of tree in the forests of western North America; today, about 6 000 individuals survive in scattered, relict populations in places of very mild, equable climate in south-central China. Distribution patterns like those represented today by alligators (two species of the genus *Alligator*), one in the south-eastern United States and the other along the Yangtze River, and the bird genus *Aix*, which also consists of only two species, the wood duck of eastern and central North America and the Mandarin duck of East Asia, resulted from similar patterns of extinction. For similar reasons, the broad, fertile plains of eastern China are home to many unique, relictual species and genera. These are precious remnants of groups that were often widely distributed across the Northern Hemisphere in earlier times. Since the natural vegetation has been reduced greatly in this area as a result of millennia of human occupation, the remnant patches of forest deserve very special attention in terms of their conservation. For this task, the Shanghai Chenshan Botanical Garden, Jiangsu Botanical Garden in Nanjing, and sister institutions in the region are especially well qualified. They should be strongly supported in this effort.

A second factor underlying the biological richness of China came about because of the impact of the Indian subcontinent with Asia, elevating the Himalayan Plateau and the numerous, often more-or-less parallel mountains of China generally. The appearance of these high mountains over the past tens of millions of years resulted in the development of a wide variety of new habitats here, particularly in and around the Hengduan and Qinlin mountains. Some 40% of China's territory lies above 2 000 meters elevation, affording ample local habitat differentiation and opportunities for biological diversitication. Dazzling arrays of species of plants, animals, and other organisms have evolved on the Tibetan Plateau and other mountains of China. These areas are often home to most of the global diversity for particular groups of plants, with hundreds of endemic species of genera such as *Rhododendron*, *Primula*, *Pedicularis*, and *Carex* often restricted to individual mountain ranges.

A third factor that adds substantially to the biological diversity of China is the fact that the country includes substantial areas of fully-developed tropical forest in southern Yunnan Province and on Hainan Island. Many species and genera for which the main area of distribution lies to the south extend northward into China; they add many species to the Chinese biota. Parenthetically, the plants of these areas need critical study to place them properly into the context of their individual groups, but they are rapidly being lost with the clearing of forests and general development of the regions where they occur. This situation calls for a greatly enhanced effort to carry out detailed biological inventories in the regions where tropical vegetation survives in China. Genetically, these species and the individual populations occur at the northern limits of distribution for the individual groups or species globally. Therefore, such populations are of extraordinary interest for their particular genetic properties and often will be useful for re-establishing populations in the very different regional climates of the future.

Because of these factors and others, China is home to at least 8% of the world's biodiversity, for example 31 500 of the estimated 400 000 species of plants and probably at least 1 million of the estimated 12 million species of eukaryotic organisms generally. I estimate that at least 2 000 additional species of Chinese plants await discovery, and almost all of them will be local and of conservation concern when they are found. More than half of these species are likely to be represented in Chinese

herbaria already, and an enhanced study of the available herbarium material should definitely be a matter of high priority for Chinese botanists; the same is true for zoological collections.

My estimate would be that fewer than 10% of the total number of eukaryotic species that occur in China have yet been discovered, described, and reported. Using plants, vertebrate animals, butterflies and a few other relatively well-known groups of organisms as a guide, about half of all species that occur in China will eventually found to be endemic to the country. Thus there appear to be about 500 000 species of endemic plants, animals, fungi, and microorganisms other than bacteria in China, and fewer than 70 000 of them have yet been recorded. Against this background, the call of Chen Yiyu, President of the National Science Foundation of China, for a biological inventory of the whole country assumes special importance and urgency. China's future sustainability will be based to a large extent on its ability to manage its biodiversity well. The information to make that task possible simply does not exist at present; thousands of unknown species are being lost with each passing year, more than half of them likely to be endemic to China. Most species that will become extinct in China, hundreds of thousands of them in this century, will remain unknown to science at the time they disappear permanently!

Human impacts on Chinese biodiversity

After more than two million years of prior history, human beings developed methods to cultivate crops successfully approximately 10 500 years, or some 400 generations, ago. The first successful cultivation of crop plants and the domestication of certain kinds of animals took place around the eastern end of the Mediterranean, and it was then replicated over the following millennia in different places in Eurasia, Africa, and the Americas. For example, rice was domesticated independently at least twice in China, once along the Yellow River and again along the plains bordering the Yangtze River, as well as independently in India, and quite possibly elsewhere.

At the time that these earlier discoveries were taking place, the global human population, spread over six continents, consisted of only several million people, a mere fraction of the population of Shanghai today. Human numbers grew rapidly because of the newfound ability to store food, thus allowing settled populations to pass through unfavorable seasons without moving to find food elsewhere. Because of the local availability of food, villages, towns, and then cities were built up in Eurasia, Africa, and the Americas. Within these growing settlements, the attributes of what we consider civilization gradually appeared, with individuals specializing in various trades or professions. Written languages were developed for the first time about 5 500 years ago, and our history began to be recorded as it occurred.

The global human population grew to several hundred million people around the time of the Han Dynasty, the time of Christ, and reached 1 billion people for the first time early in the 19th Century, 2 billion people in 1930, and 2.5 billion in 1950, and in 2010 approximately 6.9 billion people, with 2–2.5 billion more projected to be added before a level population can possibly be attained from the middle of the 21st century onward. In recent decades, China's population has not grown as rapidly as that of the rest of the world. In the mid 1930s, China had a population of some 500 million people, about 25% of the world population; today, China's 1.3 billion people amount to about 19% of the global population, still the largest number of people living in any one country. The population of Africa, growing more rapidly than that of any other area, is projected to double from just under 1 billion people now to 2 billion people by the middle of this century. By that time, the population of India is projected to exceed that of China, about 1.7 billion people in India to 1.4 billion in China.

The absolute number of individual human beings clearly is of fundamental importance in determi-

ning our collective impact on Earth's sustainability, In context, however, it must be multiplied by the level of consumption per individual and by the kinds of technology that are employed in supporting a particular area's people in order to understand total impact. For example, the U. S. uses about twice as much energy per capita as the people of any other country, and thus generates at least twice the quantity of carbon dioxide, a key greenhouse gas, per person than do the people of any other country. On the other hand, China, which has a population more than four times that of the U. S. , has just passed the U. S. in total carbon dioxide emission, but then with about a quarter of the level of emission per person than occurs in the U. S. The same relationship now holds for the production of total waste and waste per person for these two countries.

The collective pressure placed by our numbers and our activities on the sustainability of the global environment has reached frightening and rapidly increasing levels, making our common prospects for the future far from clear. The web site globalfootprint. org estimates that we are using on a continuing basis about 150% of the world's capacity for sustainability. In other words, we are rapidly depleting the sustainable resources that might otherwise make possible the maintenance of a productive, healthy, and diverse world for our descendants. In the face of this relationship, most of the world's people are striving to attain higher levels of consumption every year; the world cannot for long provide what they seek. Worldwide, perhaps as many as 2 billion people are ready to move into middle class status, but there are really no available resources to support this transition.

What is really frightening, though, is that nearly 1 billion people in the world are malnourished, having access to less than 80% of the U. N. —recommended caloric intake of 2000 Calories per day. Another 100 million people live on the verge of starvation. Although we may find short-term solutions and be able to improve the living conditions for some people, these achievements are likely to be short lived unless we make fundamental changes in the way we live. No long-term solution will ever be possible if nearly everyone in the world aspires to levels of consumption as high as possible and we remain dependent on our present technologies for our supply of energy and other purposes. Moreover, consider the 2–2. 5 billion additional people projected to be added to the world population during the next several decades. They will clearly enter the world on the lowest levels of human existence, adding inexorably to the misery that so many of us feel now. Against this background, it seems unbelievable that some governments are encouraging their citizens to have more children so that the economy will be better able to support the increasing numbers of elderly people in their populations, essentially madness in the face of well-understood relationships. Better strategies must be found!

Moving now to details of the environmental situation in China, which Jianguo Liu and I have reviewed recently (Liu & Raven, 2010), China has enjoyed three decades of exceptional economic growth and become a global economic powerhouse, with a growth rate three times faster than the world average. As the Chinese economy has grown, environmental challenges have increased rapidly. Although China has the second-largest gross domestic product (GDP) in the world, its per capita GDP is still much lower than the per capita GDP of developed countries, with strong efforts being made to increase living standards for all citizens. Despite the fact that China is striving to protect its environment and improve the efficiency of resource use, increasing environmental pollution and resource scarcity pose a severe challenge to sustainable development. Because of China's size, the ways that these and other challenges are met have major implications for the whole world.

China has chosen environmental protection as a national principle and sustainable development as a national strategy and has implemented a series of en-

vironmental programs. Despite these efforts, China's environmental sustainability index remains near the bottom among all countries. High productivity, as for example agricultural productivity, has been bought at the expense of high inputs of fertilizers and pesticides, which in turn have led to widespread pollution. Certainly both the government and general public in China have become increasingly aware of such problems and have been taking many measures to protect the environment.

In context, the production, transportation, and consumption of raw materials and products profoundly pollute the environment and lead to a variety of environmental challenges. Sustainable energy currently accounts for 7% of total energy consumed in China, with hydropower extremely important. However, coal, which is the most polluting form of energy, still predominates. More than 750 000 premature deaths annually are estimated to occur in China because of >150 μ particles emitted by coal-burning plants, a truly disturbing figure. Water shortages loom, with groundwater levels falling rapidly and much of the country's surface water too polluted for irrigation, much less for human consumption. Erosion, desertification, and urban sprawl have cut the total agricultural land drastically; the total available agricultural land is very near the minimum needed to supply China's people adequately with food. In addition, all kinds of natural habitats are being depleted and lost rapidly.

Despite widespread reluctance to do so, every country including China must develop strategies and economic metrics that take into account the environmental costs associated with its development. Development of the Chinese "green GDP" in 2004 represented a positive step in this direction, and, in view of the extent of environmental problems that are now so evident, might logically be reinstated. Indeed, on a global scale, each country must take account of the effects of its overseas activities as well if the products of such activities are to be obtained sustainably and the world as a whole is to survive in something resembling its present condition.

Turning now to the specific reasons for the extinction of plants and other organisms in China, we have already discussed habitat degradation and loss, air pollution, and water pollution, all of which not only play a major role in the loss of species, but which are likely to become increasingly important in the future. The spread of alien invasive species, including pests and pathogens, is clearly accelerating in China as it is throughout the world. These invaders are driving the loss of species in most regions and altering natural habitats, often drastically, with the accompanying loss of many species. The selective harvesting of plants, fungi, and other organisms used as medicines is an important factor contributing to the acceleration of extinction rates in China, where a large majority of the people are dependent on plants as their major sources of medicine; only about 15% of the medicines in China are derived from cultivated sources. These factors leading to extinction that have been well understood for many years, but they have now been joined by an additional factor, climate change.

In China over the past 50 years, the average temperature has increased approximately 0.26℃ degrees per decade. The average temperature in China is projected to rise 1.3–2.1℃ by 2020 and 2.3–3.3℃ by 2050. In the face of these changes, glaciers are shrinking, a factor that is alarming in relation to the availability of supplies of water here and in neighboring countries such as India in the future. Sea levels throughout the world have risen for many years and continue to rise by approximately 3 mm per year, a rate that is steadily accelerating. Climate change is a very serious factor in biological extinction, especially in a county like China, where so many species are restricted to high elevations. As mentioned above, approximately 40% of China's area lies above 2 000 m elevation, and, as the temperatures increase regionally, the high-mountain habitats for many species are likely simply to disappear, their species being lost with them.

Considering habitat destruction, climate change, the spread of invasive species, and selective hunting and gathering, it is likely that more than half of the species in the world will disappear during the 21st century. There is no apparent reason to think that the situation will be better in China. The loss of such a high proportion of global biodiversity in a single country would be a tragedy not only for China but for the world at large; whatever steps are feasible should be taken to alleviate the problem.

Strategies for plant conservation in China

The plants of China, thanks to the completion of the *Flora Reipublicae Popularis Sinicae* (Wu and Chen, 2004) and the near completion of its internationally-based revision, the *Flora of China*, which is on track to be completed in early 2013, are relatively well known. Nonetheless, thousands of species are known only from one or a few collections and a number that have not been seen in nature for decades. Probably at least 2 000 species, and perhaps even twice that many, remain to be recognized and added to the approximately 31 500 that are known now. In view of this situation, the first criterion for a truly effective program of plant conservation in China is to carry out a thorough program of exploration throughout the country and to reexamine critically the status of all groups of plants on an ongoing basis. Such an effort will lay the foundation for a really critical examination of the status of plants in China: the relative lack of knowledge of many groups of plants and many areas in China should not be underestimated.

To determine the conservation status of the plants of China according to strict IUCN criteria would be a task of mammoth proportions. In this respect, an effort is being made to achieve a level of understanding and national coordination under the direction of Qin Haining of the Chinese Academy of Sciences Institute of Botany, Beijing; some initial results have been achieved. For eastern China, it may be possible to organize an effective program for plant conservation through the collaboration of this institution with others. For other regions of China assessing the conservation status of rare and endangered plants will be even more difficult. For example, in Yunnan Province, most natural habitats at lower to middle elevations have been or are being converted rapidly to other uses, with relatively little inventory work being actively pursued. The Hengduan Mountains, the most important region for plant endemism in China, are large and rugged, with series of local species in many areas that are difficult of access. The efforts of the Kunming Institute of Botany, Chinese Academy of Sciences, together with Harvard University and other institutions, to inventory the plants of the region and determine their conservation status, are notable (Sun Hang, this symposium). Numerous seed collections are being made and stored in the Germplasm Bank at Kunming with duplicates being deposited in the Millennium Seed Bank at the Royal Botanic Gardens, Kew (Li *et al.*, 2011). It is very important that these efforts be maintained an that the populations of restricted species in the Hengduan Mountains, Qinlin Mountains, and other mountainous areas in China that are rich in endemic species be monitored continuously in the future as well in the face of climate change, increasing human population pressure, and other factors.

What kinds of plant collections should be built up in Chinese botanical gardens, including the outstanding new Chenshan Botanical Garden? In past decades, it appears that there has been far too much emphasis on the numbers of species and cultivars held by individual gardens, in a kind of competition to see which garden has the largest collection. Such efforts have very limited significance either for China and globally, and the emphasis ought to continue to be shifted to native plants and plants of conservation importance generally. Clearly some Chinese botanical gardens will specialize on horticultural plants, but they too should set more specific criteria for including individual species and cultivars in their collections than has been the case in the past, if they

are going to do an outstanding job. Mere numbers may look good in reports, but they simply do not matter in a world that sorely needs much more focused efforts! In all cases, the original sources of the plants cultivated ought to be carefully noted and recorded, with high preference being given to accessions of known native origin. In addition, genetically-adequate samples of particular species, and especially of native plants, ought to be grown to the extent possible. Such samples would amount to perhaps 30 – 50 individuals in a sexually-reproducing species. Such collections will have the greatest interest scientifically and they will also contribute most to the preservation of the species involved.

Botanical garden collections of this nature should be built up systematically, with emphasis placed on the most highly endangered species. If the botanical gardens of China would form a network, perhaps similar to that of the highly-effected Center for Plant Conservation in the United States, with each garden responsible for a particular region and a defined set of plant species held for conservation purposes, the overall cause of conservation in China would be well served. In such a system, the individual gardens commit to the maintenance of genetically-adequate samples of individual, designated species indefinitely, and also to obtaining samples of those species to be placed in seed banks. In that way, the national holdings can be increased most efficiently and the results for conservation optimized.

For the Shanghai region, the Chenshan Botanical Garden will assume the primary role in conserving native species in the future. The native area on Chenshan Hill is one important locale for pursing this goal; native plants can be established well in the Quarryhill Botanical Garden; and the areas of native vegetation that remain near the research and administration building can be maintained and perhaps enriched for conservation purposes. The outstanding greenhouse facilities, amounting to some 12 000 m^2, will play a prominent role in making it possible to establish many plant species in the Garden. Coordinating the conservation of plants in east China, using all of the strategies enumerated here and networking strongly with other botanical gardens in the region, will be an important function for this Garden in achieving its conservation objectives. The Shanghai Botanical Garden, on the other hand, will now concentrate on horticultural plants and public amenity, a role that this institution is now playing with increased effectiveness. Both gardens will continue to display a wide variety of interesting plants, and both will encourage public participation, including the enlistment of the public in the formation of effective sustainability strategies. The dual funding that these institutions enjoy from the Shanghai Municipal Government and the Chinese Academy of Sciences should allow them to coordinate their activities both in horticulture and in research well to serve the overall needs of science, conservation, and public education for the Shanghai region and beyond.

Traditionally, botanical gardens have assumed that they would be able to build up populations of endangered species and ultimately reintroduce them to natural habitats in which they would be able to maintain themselves. Doing so is difficult at best, as reviewed recently in an excellent symposium on the subject sponsored by the Center for Plant Conservation. In the modern world, where the rapid alteration and attrition of all natural habitats has become the "normal" situation, the survival of species is problematical virtually everywhere. When one considers the ongoing effects of global climate change, the situation becomes even more complex: the characteristics of site selected for reintroduction may soon change drastically, and even the conditions at the botanical garden itself where particular species are being maintained may change so drastically that their indefinite maintenance can no longer be taken for granted.

Seed storage, especially given the greatly improved techniques for dealing with seeds formerly considered "recalcitrant", may therefore prove a more dependable means of assuring the conservation

for many kinds of plants. In this connection, the establishment of a comprehensive germplasm bank for the conservation of native plants at the Kunming Institute of Botany, Chinese Academy of Sciences (Li *et al.*, 2011), is a very welcome step. Especially provided that variation within individual species is taken into account and collected, seed banks can be very effective, even though they require indefinite attention. In the long run, the reestablishment of plants held in seed banks in natural sites will of course depend on the establishment of stable climatic and other conditions in the world of the future. Without viable material of the species, obviously, nothing will be possible. Additional seed banks could certainly be established elsewhere in China, but it is highly desirable that the seed samples be collected according to uniform standards and the overall program be fully coordinated.

In nature, of course, the preservation of areas with natural vegetation remains a conservation strategy of central importance. China has been building an impressive system of nature reserves, reaching 2 538 in 2008 and occupying ~1.49 million km^2 (~15.5% of China's territory). For instance, >60 nature reserves have been established to protect giant pandas. Unfortunately, the congruence of areas rich in endemic biodiversity and nature reserves is often not close, and the boundaries of preserved areas have rarely been established in such a way as to conserve plants. Furthermore, many of reserves that have been established lack sufficient funding and suffer from ineffective management and integration with the needs of the people living near them. The control of invasive species of plants and animals generally but especially in protected areas clearly must be an integral element in any successful conservation strategy. Species that are heavily impacted by gathering them extensively in nature should be brought into cultivation, with steps taken to ensure that cultivated material will increasingly become the source of the foods, medicines, or other materials that the plant species provide.

For global climate change, mitigation on a world scale is the only strategy that offers a true defense against the widespread extinction that will otherwise result from the kinds of changes in temperatures, precipitation, and other factors that we are experiencing. To the extent that efforts to mitigate the changes prove unsuccessful, cultivation in selected habitats or the long-term preservation of seeds in seed banks appears to offer the only hope for conservation.

Concluding remarks

Achieving environmental sustainability is the most daunting challenge faced by human beings in their entire history. Considering China's goal to quadruple 2000's per capita GDP by 2020, environmental sustainability will be difficult to attain without a well-considered systems approach that engenders bold action. It is our belief and hope that China will play an elevated role in promoting the necessary global transition to sustainability, because China is endowed with growing sustainability awareness, technical capacity, improving governance, an excellent and rapidly-improving education, and rapidly increasing economic power. Population growth, levels of consumption, and the selection of particular kinds of technology are of fundamental importance in pursuing the goal of sustainability. In this regard, cooperation and trust among all nations, and especially between giants like China and the United States, are particularly important in our common efforts to build a sustainable world.

In China, greatly increased prosperity and the expansion of metropolitan areas with the massive movement of people from the countryside are posing serious problems to the continued existence of many species. The maintenance of wild areas in urban areas and around farms will not only contribute substantially to the maintenance of biodiversity, but it will also contribute directly to the education of children who live in these areas to their responsibility for helping to build a sustainable world. Botanical gar-

dens, including locally the Shanghai Botanical Garden and the Chenshan Botanical Garden, can and should take steps to directly provide information to the public about sustainability. The gardens should make it clear to those who visit the gardens that they can and should play a direct role in assisting progress toward our necessary common goal of building a sustainable world.

For the direct conservation of China's native plants, the formation of well-selected and well-funded nature reserves that take into account the ranges of threatened and endangered plants; the cultivation of genetically-adequate samples of selected plants in botanical gardens, accompanied by efforts to reintroduce them in nature; and the storage of large sample of seeds representing the genetic diversity of species in seed banks, will all be important strategies. In attaining the overall goal of conservation, however, nothing is of more fundamental importance than educating the general public about sustainability and especially building in all children an appreciation of nature and the role of human beings here on Earth. That is a noble cause, and one for which botanical gardens are especially well suited. All of us gathered here wish both botanical gardens in Shanghai, and all of the similar institutions in China, every success in developing their programs and especially in their efforts to preserve plant diversity for the future.

Summary of recommendations for plant conservation in China

1. Rigorous inventories of plants need to be pursued in many areas of China and made available generally.

2. The conservation status of all relatively uncommon plants in China ought to be determined according to IUCN-recommended standards.

3. Both recommended activities should be greatly accelerated in relatively poorly-known areas that are rich in endemic species, such as the Hengduan and Qinlin mountains.

4. In areas such as Yunnan Province, where deforestation and the destruction of natural vegetation is proceeding rapidly, these activities particularly need to be accelerated.

5. In the East China Plane botanical inventory needs to be updated and the conservation evaluation of species should be intensified, accompanied by the intensification of conservation activities in the region.

6. Genetically adequate samples of rare pant species, especially of those most highly endangered, should be brought into cultivation in botanical gardens. These taxa should be reintroduced to native habitats to the extent possible, with the results of these attempts studied and generalized.

7. Merely accumulating high numbers of species and cultivars should not be taken as an appropriate measure of success for botanical gardens; the quality and nature of their collections provide much more important goals, and conservation should predominate as a rationale for building the size of botanical garden collections.

8. In a world of accelerating global climate change, seed banks will become increasingly necessary as a central strategy for conserving plants. Therefore, increasing the number and quality of samples in seed banks should receive a very high priority in conserving Chinese and other plants.

9. Conservation will take place in nature reserves and similar areas, which now comprise about one sixth of the total area of China; these protected areas, however, often lack adequate funding and are often not integrated well enough with the local communities in their vicinities.

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